CONTRIBUTION TO THE DIAGNOSIS AND SURGICAL TREATMENT OF TUMORS OF THE CEREBRUM.

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I.

The case which forms the basis of this contribution to a novel field of surgical progress, presents many points of interest in relation to diagnosis, and illustrates the possibility of the removal of a deeply placed tumor, and the prolongation of life through operation. The medical and surgical remarks upon the subject which the case illustrates are separately made by the authors.

History of the Case. [By Dr. Seguin.]

Mr. B., æt. thirty-nine, married, German, brewer, residing in Bridgeport, Conn.; attending physician Dr. Charles C. Godfrey.[1] Was first seen during my absence by Dr. J. Arthur Booth on August 12, 1887. The following is a transcript of the notes then taken:

Is a strong-looking German. Has been married ten years; has four healthy children. Wife has had no miscarriages. There is no history of gonorrhœa, or chancre, or of any syphilitic symptom. Has been in the habit of drinking beer, but no strong drink. Has smoked moderately. Is right-handed. No epileptic attacks in childhood. Was perfectly healthy until the autumn of 1882. He then had malarial fever, apparently of mixed remittent and intermittent forms. During this illness he had a good deal of pain in the head, and one day, feeling strangely, he got up to go to the window, when his wife observed a spasm of the right cheek and neck (head and face turned to the right). This was a twitching spasm, and did not involve the arm; consciousness was not lost. A similar attack occurred a year later, and during the third year he had an occasional attack in the night. She is positive that until 1885 there were no spasmodic movements in the hand or arm. He was otherwise well, with the exception of an occasional headache, until two years ago, when one day he fell unconscious and bit his tongue. He has had similar attacks at long intervals since; they lasted only a few seconds and left him very weak. These epileptic attacks were preceded by an aura consisting of a "frightened feeling," followed by twitching or jerking in the right hand and arm and in the right side of the face, followed by loss of consciousness.

The attacks have occurred at all hours, and no exciting cause has been observed. Has taken bromide of potassium lately, and has had fewer attacks. Memory not as good as formerly, and speech has become "thick" (bromide effect?). General health has remained good.

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[1] The authors of this paper desire to express their obligation to Dr. Godfrey for his hearty coöperation in the management of this case, and for his skilful treatment of it during the long period in which it was under his individual care.

Examination.—Stands well with eyes closed. No tremor of tongue or fingers. Tongue deviates slightly to the right. Vision is good; never diplopia. The right hand is weak; dynamometer showing R. 30° and 32°; L. 35° and 32°. No ataxia. Patellar reflex normal. (State of facial muscles not noted.)

Treatment.—To stop beer entirely; to take twenty grains of bromide of sodium morning and noon, and forty grains at bedtime.

August 26. Dr. Seguin's notes. Patient now states that the first epileptiform attack was five years ago. A long interval follows, as above noted. Again denies, in most positive terms, the occurrence of chancre or any syphilitic symptom. No injury to head. Attacks always begin in the right facial muscles; speech is almost wholly suspended, even when consciousness is fully preserved. Can call out "water" or "ices," but cannot talk. He has had no motor attacks in the hand alone. Patient is not aware of weakness of the right hand and arm, but admits that he is awkward with this member, and that his handwriting has become bad. In the last eight or nine months the right upper extremity has felt heavy or "numb." Speech is said to have been thick and slow for over two years. Memory much impaired.

Examination.—Pupils equal, of medium size and active; muscles all act well (no prism-test). The optic nerves and retinal vessels appear perfectly normal. The lower facial muscles on the right side are distinctly paretic, and there is slight deviation of the tongue to the right. Can close left eye alone, but not right; frontalis normal. The right arm is paretic; grasp, R. 32° and 30°; L. 33° and 35°. Stands equally well on either foot; the walk is normal. Patellar reflex slightly greater on the right side. Sensibility is unimpaired, except a very slight diminution of tactile sensibility, as tested by æsthesiometer, on the right cheek. Mental action slow but accurate.

Recent attacks: about June 10th or 12th, August 11th, 16th, and 18th. Intermittent fever has reappeared; a chill followed by high fever on August 21st, 23d, and 25th.

Symptomatic diagnosis.—Right-sided Jacksonian epilepsy, with facio-brachial paresis.

Anatomical diagnosis.—Tumor of the left motor zone in the facial centre.

Treatment.—Ordered a mixture containing to each dose, Fowler's solution, 5 minims; bromide of potassium, 20 grains; iodide of potassium, 15 grains; fluid ext. of rhamnus frang., ʒss, on rising, after midday meal, and at bedtime. For tertian fever, to take sulphate of quinine 20 grains to-night, and 10 grains every night afterward.

September 21. Comes with Dr. Godfrey. Has had only one severe epileptic attack since last call, viz., on August 31st. On September 17th, had a slight localized attack in the right cheek. Speech is worse; slow and somewhat interrupted, though not, strictly speaking, syllabic. The patient himself has noticed the aggravation, and adds that he can't always think of the right word to speak. On September 13th, had a chill followed by fever. During this attack he had severe pain in the left side of the head. No constant headache; no vertigo. Complains of a constant feeling of numbness, or a numb-weight in the whole of right upper extremity, but not in cheek, tongue, chest, or leg. Has been somewhat drowsy in daytime.

Examination.—Pupils and optic nerves are normal, right facial muscles as before. Tongue tremulous, but nearly straight. Paresis of right arm more pronounced: grasp, R. 36°, 37°, 37°; L. 40°, 37°, 39°. Stands less well on right foot (eyes closed). Patellar reflex is greater on right side.

Sensibility. No anæsthesia of face. On pulps of left fingers the points of the æsthesiometer are distinguished at from 2 to 3 mm., on the right at from 3 to 5 mm. This slight tactile anæsthesia is most marked on thumb and index. Feels texture of cloth as well with right as with left fingers. The muscular sense, as tested by passive movements and weights, when eyes are closed, is normal.

The desirability and feasibility of an operation in the near future, if symptoms increase, are discussed with Dr. Godfrey. I feel reasonably certain that the lesion is a tumor affecting the motor apparatus of the left hemisphere, in the parts associated with the face and hand. Whether the tumor is cortical or subcortical is open to doubt. The local twitching, or clonic spasm being in favor of a cortical lesion, while the absence of (constant) headache would strongly point to a medullary lesion.

October 19. Has had several seizures. One (on September 23d), beginning as usual in the right face, became a complete epileptic attack with biting of the tongue. States that frequently after attacks the right cheek is flushed and hotter than the left. Has had more severe and more constant pain in the left parietal region. The hemi-paresis is worse; saliva flows almost constantly from angle of mouth; the right cheek and buccal muscles are almost powerless; the tongue deviates very slightly to right (not at all in proportion to the facial paralysis); the anæsthesia, though very slight, is demonstrable on right face and hand; to coarse tests the muscular sense is normal in upper extremity. Percussion develops tenderness over an oval area 2½ x 2 inches above the left ear, and overlying the motor zone. I advise an operation, exploratory at least, as soon as the patient can be induced to submit to it.

November 15. Mr. B. comes to New York expressly to have the operation performed. Since last date, a thorough trial of iodide of potassium, to 200 grains three times a day (four days at that dose), has been made, without good or bad effects. The bromide has been continued at an average dose of sixty grains *per diem*, but several partial attacks have occurred.

A careful physical examination reveals substantially the same symptoms, viz., paralysis of right lower facial muscles, paresis of right arm (grasp: R. 23°; L. 40°); leg apparently normal; constant drooling from right side of mouth; slight aphasic and agraphic faults. Anæsthesia as before, tactile, and very slight; muscular sense preserved. No symptoms in optic apparatus. The greatest tenderness to percussion, coinciding with seat of greatest constant pain, is in a spot just in front of the auriculo-bregmatic line, and from 8 to 10 centimetres (3 to 4 inches) above the external auditory meatus.[1] The patient was sent to Dr. R. F. Weir to be examined by him with a view to operation, and was admitted the same day to the New York Hospital as a private patient in his service.

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[1] This area of tenderness was marked at the time upon a cranial diagram, and subsequent comparison of this sketch with that represented by Fig. 1, and with the estimated actual location of the tumor at the time of operation, was made.

On the same day careful measurements of the cranial temperature were made upon the shaven scalp. The instruments used were four of a set of Seguin's surface thermometers, self-registering, made expressly for me by Casella, of London, in 1883. These thermometers were not graduated until four months after making, and Mr. Casella guaranteed their accuracy. Just before using them to-day, I tested the entire set of twenty instruments, comparatively, in water at about the normal temperature of the body, and found that most of them agreed to $\frac{1}{10}$° C., and the others (with one exception) within $\frac{1}{5}$° C. Four of the most accurate were used upon the patient; each instrument being held firmly upon the scalp (with enough force to leave an indentation) for five minutes. The results were recorded by an assistant, while Dr. Gordon, the House Surgeon, and myself managed the instruments. The following is the tabulated result in Fahrenheit degrees.

	Right side.	Left side.
Frontal regions	93.2°	94.3°
Temporal regions	98.0°	96.0°
Vertex one inch from median line	96.8°	95.0°
Occipital region	94.1°	97.2°
Over supposed site of tumor	96.3°	97.7°

Nov. 17. The measurements were taken again in the same manner. Temperature of room 78.5°. Axillary temperature of patient 97.7° (hospital thermometer).

	Right side.	Left side.
Frontal regions	95.0°	96.4°
Temporal regions	97.2°	96.8°
Vertex one inch from median line	96.4°	96.4°
Occipital region	96.4°	97.2°
Just above edge of ears	97.7°	98.0°
Half way up Rolandic line	96.8°	96.4°
Over supposed seat of tumor	96.1+°	96.1°

The averages of these measurements for the two sides of the cranium were:

	Right.	Left.
First series	95.7°	96.0°
Second series	96.5°	96.75°
	96.1°	96.37°

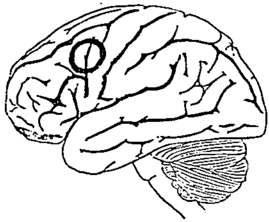
The temperature over the supposed seat of the tumor was 1.4° higher on the left side the first day, but on the second day no differences of any moment were noted.

For the whole head these averages were almost in accord with those of Maragliano and Seppilli (96.98°), and higher than those of Gray (95.5°). As the averages of Gray represent more nearly the normal in our climate and in our inhabitants, we must conclude that in the case of Mr. B. there was a general elevation of cranial temperature amounting to about 0.7°.

These thermometrical results appear specifically worthless; yet the absence of positive elevation of temperature over the supposed site of the tumor might be added to other indications to be referred to later, and which led us to be prepared for a subcortical lesion.

Final diagnosis.—It is almost certain that Mr. B. has a cerebral tumor involving the centre for the face and partly that for the arm in the left hemisphere. On account of the late appearance of headache, and the absence of marked elevation of temperature over the seat of the tumor, we must not be unprepared to find a subcortical tumor. Nature of tumor uncertain, probably a sarcoma. The appended figure is a reduction of an Ecker diagram with the probable site of the tumor marked by a heavy ring, drawn before the operation, which was done by Dr. Weir on November 17th. The tumor was found, deep under the surface of the brain, in the indicated location. Although, surgically speaking, it was a subcortical tumor, yet it probably invaded the cortical gray matter deep in the sulcus between the gyri (*vide* Figs. 3 and 4).

FIG. 1.



Outline diagram of left hemisphere. The dark ring represents the site of the tumor, estimated before the operation.

THE OPERATION. [BY DR. WEIR.]

The operation was performed with the assistance of Drs. Seguin and Bull, under ether and with antiseptic precautions, spray included, Nov. 17, 1887. The patient's head, shaved the previous day, had been for twenty-four hours covered with gauze moistened with 1 to 60 carbolic acid, after a thorough scouring with whale-oil soap and water. The auriculo-bregmatic line was marked out by Dr. Seguin on the scalp, and at a point a little in front of this line and just anterior to the lower half of the fissure of Rolando a minute perforation was made through the scalp and through this a mark made with a sharp pencil to indicate on the skull, when exposed, the place to be centred by the trephine. An oval flap of the scalp, three inches broad and including the periosteum, was then raised from the skull in such a way that its base was toward the frontal region. This was held back by a suture at its apex to the eyebrow, and the many arterial and venous bleeding points secured by clamps. The first button of bone with a one inch trephine was removed about one and a half inches above and a little in front of the left ear. A second button of a similar size was taken away just in front of this and a little above it. The intervening portions of bone were rapidly gnawed away with a double gouge forceps, and the cranial opening enlarged on all sides in the same way until it reached an area of three by two inches.

The dura mater bulged only slightly but pulsated freely, and presented a normal appearance. It was opened by lifting a part with a tenaculum and by first penetrating it with a knife, and then cutting it with curved blunt scissors a quarter of an inch from the skull edge for about three-quarters of the circumference of the hole, leaving the attached part uppermost. This flap was then reflected (Fig. 2). One of the vessels of the pia was wounded in the procedure and was ligated after some little difficulty. The middle meningeal vessels crossing over the dura were secured, partly before the incision in this membrane, by a curved needle carrying catgut through the dura, an expedient taught me by my venerated preceptor Dr. Gurdon Buck, or by tying the vessels as they were cut. Two branches at the lower part of the wound were, however, only controlled by small sponges at first, and subsequently by iodoform gauze pressed between the dura and the skull.

FIG. 2.

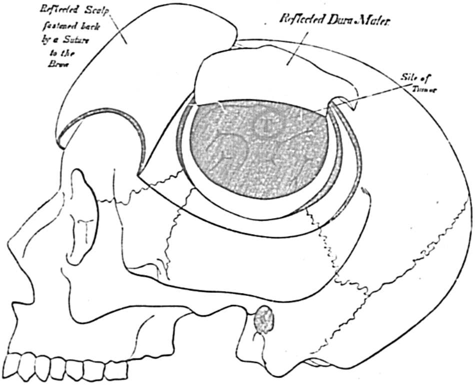


Diagram showing lines of incision and location of tumor.

As the brain itself was exposed it was noticed to bulge decidedly into the opening, but its pulsations were manifest. Nothing abnormal was seen on the exposed surface, though by some it was supposed the convolution situated most posteriorly was violet in color. This was thought, however, by me, to be due to the recent extravasation (alluded to above) from the damaged pia vessel. The finger recognized no tumor or abnormality. Quite firm but gradual pressure, sufficient to permit the finger to be carried below the skull level and slightly beyond the area of the bone opening, furthermore revealed nothing. It began to appear as if the growth was beyond the reach of surgical art, when firm pressure posteriorly encountered a deep resistance of a hard mass of small size underneath the previously suspected convolution. The convolution was gently parted with the finger-nail and a director, and at a depth of nearly an inch, directly inward and in probable close proximity to the upper part of the ventricle a mass was exposed to the touch, and subsequently indefinitely to sight by means of gently used retractors, made of bent spoon handles. It was then ascertained to be a growth nearly the size of a large almond, or, more correctly, in shape and size as large as the end of the forefinger, not encapsulated and seemingly infiltrated into the brain tissue. It was, after a brief trial to remove it with a director, lifted out readily with a Volkmann's spoon one-half inch in diameter, which had been previously blunted for the purpose.

After the tumor had been taken away a separate hard piece the size of a pea was recognized and also removed. The finger could now be passed to the depth of fully an inch and a half, and it gave me the impression of being in a smooth cavity. No hemorrhage from the brain itself occurred. The normal condition of the brain having been corroborated by Dr. Seguin's digital examination, a rubber drainage tube was carried to the bottom of the cavity and out through the posterior margin of the wound. The dura mater was stitched together except over a small area where the tube emerged, and after a final washing of the wound with a 1 : 5000 sublimate solution had been done.

FIG. 3.

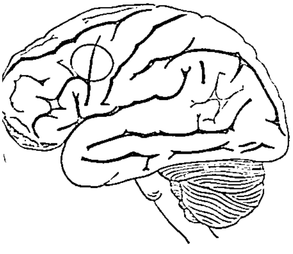


FIG. 4.

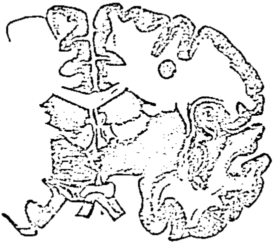


Fig. 3.—Outline diagram of left hemisphere, with ring showing topography of tumor.

Fig. 4.—Diagram of oblique transection passing through tumor (Pitres's *coupe frontale*), showing the actual location of the tumor as determined by the operation.

The disks of bone and a number of the bone fragments which had been chipped off by the rongeur were replaced over the sewn dura. These disks and pieces of bone had been kept in a towel wet with 1 to 60 carbolic acid, and kept at a suitable temperature by immersing the jar containing them in warm water for over an hour. Two strands of horsehair and one of catgut were placed under the replaced scalp for drainage, and a fresh piece of iodoform gauze tucked between the skull and dura mater at its lower part where the meningeal oozing was still troublesome, and after suturing the scalp with catgut, a sublimate dressing dusted with iodoform, was applied with moderate pressure. At the termination of the operation pulse 125. General condition good.

The tumor lay entirely within the white substance and was situated, in the judgment of Dr. Seguin, at a depth of three-quarters to one inch below the posterior edge of the second frontal and the anterior edge of the precentral gyri; that is, approximately in the fasciculus for the face. This location in a transverse projection corresponds to Bitot's section No. 3, and is a little behind Pitres's pediculo-frontal section. The location of the tumor in depth is approximately represented by Fig. 4, made from an oblique transection, corresponding with the frontal section of Pitres.

Pathologist's Report.—The microscopical examination of the tumor, made by Dr. Peabody, pathologist to the hospital, was as follows:

Sections of the tumor show it to be made up chiefly of round and oval cells, with a rather abundant stroma of finely fibrillated connective tissue. These cells vary in size from that of white blood cells to that of three to four times their size. The superficial parts of the growth contain numerous large bloodvessels with very thin walls. There is no perivasculitis. On one side of the tumor there is a thin layer of white matter (visible to the unaided eye) which is distinctly fibrillated, with cells like those of the tumor itself. No glioma cells can be obtained by appropriate treatment. Diagnosis—Sarcoma.

During the operation there was more hemorrhage from the divided scalp vessels than in my opinion should be hereafter allowed. Clamps and ligatures hold poorly in the tough tissues of the scalp, and it is believed that the use of acupressure needles, at least during the operation, would answer better. The operation lasted about one and three-quarters hours, and was prolonged by the difficulties in controlling the hemorrhage from the scalp, dura, and pia mater.

Three or four hours later, when the patient had come out of the ether, it was noticed that he moved his right leg well, and his arm as before. He was slightly aphasic, and his facial paralysis was somewhat more marked. At 10 P.M. Temp. 99°; resp. 24; pulse 132. Given sod. brom. grs. xv. At 11.30 P.M. ordered peptonized milk, ℥j; brandy, ʒj, q. 2 h.

18th. Given hypodermatic of Magendie, ♏iij, at 1.30 A.M. Catheterized at 2.45, 10 ounces of urine drawn. Was very restless during the night. Vomited slightly at 8 A.M. Temp. 102°; resp. 24; pulse 124. Hypodermatic of antipyrin, grs. v, at 11 P.M.; to be repeated every three hours as long as the temperature keeps above 100°. Given milk and lime-water, ℥ij, q. 2 h.

19th. Vomited three times during the morning. Temp., A.M., 100°; resp. 22; pulse 112. Catheterized at 9 A.M. Milk continued as on yesterday. Is fully conscious of everything going on around him. Aphasia more marked than before the operation. Facial paralysis about the same as before operation.

20th. Temp. 99°; pulse 90. The dressings were changed to-day, and as the rubber drain contained clots, suggesting the fact that it did not drain well, it was removed. The one and a half inch thick dressing was pretty well soaked with dried bloody discharge. The horsehair drains were also withdrawn, and only the catgut drain left in. The iodoform tampon was also removed. The scalp was found blistered, owing to irritant effect of the too damp bichloride compresses. This accounted, I think, for the temperature in part at least. Carbolic spray used while dressing was done. Dry sublimate and iodoform dressings applied. Decided improvement in patient this morning; aphasia not nearly so marked.

21st. This morning the temperature was 99.8°, resp. 20, pulse 90. From this date the patient progressed steadily. A second dressing was made on the 27th inst., ten days after the operation, when the whole wound was found healed, save a small spot where the drainage tube had merged. The replaced bone appeared firm. The patient's aphasia had nearly disappeared by this time, and his appreciation of a joke was quite keen. By December 4th he was out of bed, sitting up. The scalp was firmly united, the replaced bone disks solid, and the cranial gap entirely occluded with bone, except at its lower part, where the fragments had been dislodged by the emergence and withdrawal of the iodoform tampon.

SUBSEQUENT HISTORY. [BY DR. SEGUIN.]

The operation was followed by temporary complete paralysis of the right limbs, and nearly complete aphasia. So marked was the last symptom that, for a few hours, we feared that the third frontal gyrus had been injured, but this fear proved groundless. From the day of operation until November 24th, fifteen grains of bromide of sodium were given at bedtime. On November 24th this dose was increased to thirty grains. By a misunderstanding, no bromide was given from November 27th to December 3d, when he was ordered ℞., Sodii bromidi, ℥jss; syr. aurant. cort. ℥jss; aqua, ad ℥vj; one teaspoonful (equal to seventeen grains of bromide) three times a day.

I examined the patient at the New York Hospital on December 8th, twenty-one days after the operation. He was in bed, calm, clear-minded, and in good general condition. No convulsions had occurred. The upper facial muscles act equally well on both sides, except that the left eye cannot be closed independently of the right. In repose, the lower part of the face appears nearly normal. The right lips are weaker and less expressive than the left, the right naso-labial crease has reappeared, and is nearly equal to the left. In speaking or showing teeth, or forming lips to make o sound, the inactivity of the right lips becomes evident. The tongue protrudes almost perfectly straight, going a trifle to the right. In smiling, both sides of the face act equally well. There is no drooling. The left pupil is a trifle larger than the right; both active. Optic nerves and retinal vessels normal.

Upper extremities.—No tremor in extension. The small muscles of the right hand still show some atrophy, though, perhaps, less than at last note. Grasp on dynamometer: right, 22° and 25°; left, 30° and 30°. Coördination is practically perfect. Unbuttoning and buttoning shirt with right fingers alone, is successfully done, though slowly, and a little awkwardly. All voluntary movements are well and quickly made with right foot, coördination (heel-on-patella test) normal. Thoracic and abdominal muscles act well. Circumference of right calf 32 centimetres (12½ inches), of left 31 centimetres (12 inches). No wrist reflex. Knee-jerk high, but equal on two sides. The same is true of the plantar reflex.

Sensibility.—On the face a light touch with finger is equally well felt on both sides, except that on the lips sensation is, perhaps, more acute on the left side. The points of the æsthesiometer are distinguished on the left cheek and chin at 10 mm., on the right side at from 10 to 15 mm. The greatest difference exists on the upper lip, above moustache. On red surface of lips points are separately recognized as follows: left upper lip, 6 to 8 mm.; right upper lip, 10 to 18 mm. Left lower lip at 4 mm.; right lower lip, 8 to 10 mm. On the tongue, average on the left side, 3 mm.; on the right side, 4 to 5 mm. The patient claims to taste his food properly on both sides of the tongue. Pricking is equally felt on both sides of the face.

Upper extremity.—To light contact there is slight dulness of sensibility on the right hand and forearm, but impressions are correctly localized. Æsthesiometer points are distinguished at between 3 and 4 mm. on pulps of fingers of both hands; a little closer on the left side. Pricking is more acutely felt on the left fingers, hand, and forearm, than on the right. Appreciates heat and cold quickly on right hand. Muscular sense tested with eyes closed. Can maintain right arm in extended position several minutes. Passive movements are quickly and correctly appreciated. Distinguishes small differences in weight in right hand, and recognizes that two silver half dollars, laid one after the other on the right palm are of the same weight. Sensibility of feet and legs normal. Speech is slightly thick, and patient occasionally hesitates for the word; cannot utter it quickly.

Dec. 10. At about 10 A.M. had a convulsive attack. He rang for the nurse, and told her a fit was coming on. She reports that his face was then twitching on the right side, about the nose and beneath the eye; the right forearm was convulsed. Then he became unconscious, and had a general convulsion, the movements being more marked on the right side. Both pupils were dilated and equal; there was internal strabismus of the left eye, and the head was turned to the left. The convulsion lasted about one and a half minutes, and there was a short subsequent coma; pulse 120, but no rise of temperature.

11th. Seems as well as before attack, except some mental depression.

16th. Allowed to walk a little. At 8.15 P.M. had another convulsion.

17th. One month after operation is allowed to go home, in good general condition, and unquestionably better as regards paresis of face and hand.

On the 21st Dr. Godfrey had the kindness to send me the following report: "Mr. B. arrived at 12.45 P.M. I saw him at 1.30 P.M., and found him feeling very comfortable after his journey. Pulse 72; temp. 98.4°; resp. 17. I ordered for him the medicine as you directed (this was a solution the dose of which consisted of Fowler's solution, ♏v; iodide of potassium, 15 grains; bromide of potassium, 22 grains; water, ʒij; to be taken, largely diluted, on waking, after dinner, and after supper). I have ordered him to be kept very quiet for a time, and his wife carries out this instruction very well. He had a slight attack of epileptiform convulsion yesterday, but it was very quickly controlled by the amyl nitrite. His wife says that since returning home he has been more quiet, and his mind more at ease than when in the hospital. *The amount of power exhibited in his right hand and arm is a complete surprise to me, and his speech is better than I have known it in a long time.*"

On Jan. 23, 1888, Mr. B. came to New York to see Dr. Weir and me at my office. He walked in as erect and active as any one, and passed through a trying examination fairly well. Mental action is good, speech a little slow, but not aphasic (seldom pauses for the word). Has had no marked attack in two weeks; only an occasional twitching of the facial muscles. Has also had a few vertiginous or faint feelings.

The pupils are equal and normal The upper facial muscles (naturally weak) act fairly well on both sides, less on right. The mouth shows some deviation to the left in repose. In showing teeth, paresis of right cheek and lips becomes evident. In laughing both sides act equally. There is no drooling. On the whole, the face is rather expressionless, somewhat like that of paralysis agitans. The right upper extremity is paretic; grasp, R. 26° and 26°; L. 35° and 33°. Movements of lower extremity normal.

Sensibility.—To light touch of end of pencil there is no difference between the two sides of the forehead, ears, and neck. On the rest of the face there is a distinct dulness of perception on the right side. The æsthesiometer test shows no difference on the forehead. On the cheeks, around mouth, and on chin, the points are distinguished at greater intervals on the right side; a difference of 50 and 75 per cent. in places. Light touch is less well felt on the right than on the left hand, and the dulness is most marked on the ends of the thumbs and fingers; dorsum and palm equally sensitive. The æsthesiometer, however, reveals no anæsthesia. Sensibility to passive movements and judgments of weight (loaded rubber balls) unimpaired. On February 29th Dr. Godfrey wrote at length about the patient's condition; the following being essential points. No attacks of any sort occurred from Jan. 9th to Feb. 25th (forty-five days), when, after a chill in the night, he had a spasm "mostly limited to the right side," at 8 A. M., followed by paresis of the hand. Since, symptoms of severe remittent fever (pyrexia, jaundice, pain and tenderness over liver, occasional chills) have been present, and have been treated with quinine and calomel, the bromide being continued.

March 8. I went to Bridgeport and examined Mr. B. with Dr. Godfrey. The actual objective symptoms of cerebral disease are as at last note, but the patient is generally very feeble, shows some jaundice, and a little fever. There is much more aphasia than at any time; so much as to render tests of sensibility unreliable. I am of the opinion that this is temporary, and only dependent upon asthenia. From 40 to 60 grains of bromide of sodium to be given, besides the necessary general treatment.

March 19. During an exacerbation of fever there occurred a convulsive attack in the right hand. A similar spasm on the 25th. On the 26th a seizure (well described by his wife) occurred, consisting of only a few clonic flexion movements of the right thumb.

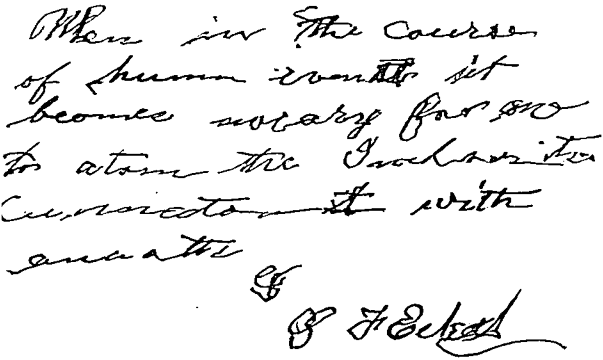
April 3. I again visited the patient, and noted his condition as follows: Mr. B. is calm, clear-minded, and cheerful. Articulation is slightly defective, phonation normal, he occasionally hesitates for a word; in answer to questions, he states that he knows the word he wants, but cannot utter it. The jaundice has almost disappeared; the tongue is clean, appetite fair, axillary temperature 99°, pulse of good strength, about 90.

Examination.—Face in repose rather expressionless, which I think is normal. Right lower face less expressive than left. Pupils of medium size, active, the left a little larger. Vision not tested, and fundus not examined. In smiling and laughing (which the patient does heartily at a medical story) both sides of the face act well. The right eye cannot be voluntarily closed alone, whereas the left can.. In volitional effort almost complete inactivity of the right lower facial and buccal muscles. The tongue protrudes almost straight (a trifle to the right). All movements of upper extremities are well and quickly done. The grasp is: R. 11° and 11°; left 21° and 25°. In extension the *left* fingers exhibit some tremor. The interossei of the right hand are somewhat atrophied. Movements of the leg not tested (patient in bed), but his wife states that he steps well with both legs.

Sensibility.—Face not tested. Declares most positively (to repeated questions) that the right hand no longer feels "numb." Feels the lightest touch on right fingers and hand, and with eyes closed he distinguishes consecutive contacts with coarse bed-cover, thin handkerchief, and a sheet of paper. Æsthesiometer points are differentiated at about three millimetres on left finger-tips, and at four on right finger-tips. Feels temperature equally well on both hands (and fingers). Muscular sense: with eyes closed, recognizes such objects as a key, a knife, and a piece of money placed in his right hand. A twenty-dollar gold piece being placed in it, he calls it a dollar; a half-dollar he calls a quarter, but he recognizes the difference between the weight of a half-dollar and that of a quarter-dollar. With rubber balls loaded to a difference of half an ounce up to four ounces, he recognizes differences quickly.

Mrs. B. states that since the return home convulsive movements have not appeared in the cheek.

FIG. 5.



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Reproduction of Mr. B.'s writing April 4, 1888, showing agraphic as well as simple motor defects. (The patient never wrote a very good hand, and was not a good speller.)

On April 4th Dr. Godfrey made some tests of the patient's ability to write. The few short attempts made caused great fatigue. By simple dictation next to no result was obtained. A copy of the opening paragraph of the Declaration of Independence was placed before the patient and was partly copied, partly written by dictation, with the copy before him. The result, represented on page 36, shows faults due to the lack of strength and coördination, but also distinctly agraphic faults. There was no alexia.

It thus appears that nearly five months after the removal of Mr. B.'s cerebral tumor there is no very positive evidence of recurrence of the growth. The increased aphasia and agraphia may possibly indicate the invasion of more cerebral tissue by sarcomatous cells; but this is not so certain, because the aphasia has greatly diminished from March 8th, and it is impossible to determine how much the remaining debility, due to the remittent fever, may be resposible for symptoms now present.

It is greatly to be regretted that the normal course of the case should have been so obscured and modified by an intercurrent disease.

POST-SCRIPTUM.—*June 6th.* Mr. B. goes to Europe for a stay of two or three months. He comes to my office alone, and is himself attending to the details of the voyage. General health has greatly improved; is stout and florid. Attacks as follows, since last note: April 24th, slight clonic spasm in right hand; 28th, had a convulsion, beginning by local spasm in hand as usual, no biting of tongue; 30th, twitching of right thumb. May 14th, subjective spasm in right cheek and tongue, speech suspended for a few minutes; attack witnessed by wife, who says there was no visible spasm or impairment of consciousness; 26th, jerking of right thumb for a few moments. No return of fever; only occasional slight headache; all functions normal. Speech has varied in freedom from day to day.

Examination.—Apparently in perfect health; pulse 84. Speech a little slow, pauses for a word occasionally, but usually finds it. No headache to-day. Thinks that right hand has become weaker (which is an error), and states that a wooden or dead feeling (not formication) is present in fingers, most in medius, not in thumb, or palm, or in face. Drools occasionally from right buccal angle. Paresis of right lips and cheek, as at last note. The tongue is straight, but trembles and looks somewhat shrivelled, as in some cases of dementia paralytica. Grasp: right hand, 19½°, 20°, 22°; left hand, 33°, 25°, 28°. Coördination of hand perfect. Stands perfectly well with eyes open and closed, on one or both feet; walk normal. Patellar reflex normal, and equal on both sides; no wrist reflex. Sensibility is normal to touch, temperature normal, pricking on finger-tips and hands. Æsthesiometric limits on pulps of right fingers, 3 mm. Can distinguish differences in weight of only a few grains in right hand, and is fully conscious of all passive movements. Vision $= \frac{20}{\text{xx}}$; optic nerves normal.

Treatment.—On May 9th was given (in place of simple bromide solution) a solution of hydrate of chloral 7.50 gm., sodium bromide 37.50 gm., water 200 gm., each teaspoonful containing 3 grains of chloral and 12 grains of bromide of sodium. Dose, 2 teaspoonfuls on rising, 1 teaspoonful at midday, 1½ teaspoonfuls after evening meal; equal to about

4.5 gm., or 67 grains of the anti-epileptic salts per diem. Also, more or less regularly, a pill containing arsenious acid 0.001, podophyllin 0.004, ext. belladonna 0.015, quin. sulph. 0.20, after each meal. This treatment is to be continued faithfully while away. Is to avoid over-exertion, excitement, and exposure to great heat.

ON THE INFLUENCE OF BODILY MOVEMENTS OVER SEPTIC ABSORPTION.

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It is well known that the act of respiration is composed of four periods, namely, inspiration, expiration, and an interval between each, called pauses. Ordinarily, the duration of the pauses is much shorter than that of the other stages; and of the pauses, that between expiration and inspiration the shorter; and of the respiratory acts the inspiratory rather the shorter.

The inspiratory act increases the capacity of the thorax by increasing its diameter—most apparent at its base—and also by depressing the diaphragm, or, in other words, by obliterating, in a degree, its natural upward convexity. This alteration of shape is effected by its own muscular action, and by the stretching effect produced by the increased diameter of its circumferential attachments; normally, these movements are synchronous. When, then, by the act of inspiration the capacity of the chest is increased, a tendency to vacuum exists, which is corrected by two methods: 1st, by the ingress of air through the larynx; 2d, by the flow of blood through the various veins leading toward the heart; for, during inspiration, the normal support of these vessels, which exists during the pause preceding, is lessened, and thus the external air-pressure existing on the general vascular system immediately acts, and corrects the lessened tension by pressing the blood heartward. Thus, in the respiratory act we have a force of considerable influence supplementing the heart-action.

But there is another part of the body which it is also necessary to consider before we can fully apply these facts to the elucidation of our subject. When the diaphragm descends it presses on the contents of the abdomen, and these being more or less plastic, obeying the laws of elastic fluids, press correspondingly in all directions. And although the increased diameter of the base of the chest, to which the walls of